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VISUAL RESOURCE INVENTORY
AND ANALYSIS FOR THE ALASKA LANDSCAPE

Prepared by

Ronald W. Sullivan, Landscape Architect

Daniel G. Laurizio, Landscape Architect

For

Bureau of Land Management

Alaska State Office

Fairbanks District

Arctic - Kobuk Resource Area

Northwest Planning Unit

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foreword

Bureau guidance responds to situations more common to the lower 48 states, particularily the eleven western states for which public land management has well understood parameters. Application of many of the principles identified in manual releases need to be modified or changed entirely to fit Alaska. This report represents a pioneer effort to develop a visual resource inventory system that addresses Alaska, its vast and diverse landscapes, and the largely pristine condition which sets it apart from the straight application of current manual direction.

The strategic objective was "to develop methodology for a descriptive visual resource inventory". The key word is descriptive. The current procedure is not a descriptive inventory but is actually a part of the Unit Resource Analysis. As such, collected data is evaluated and never really recorded in its primary form. Once evaluated, this information loses much of its utility for other purposes. The stated purpose of the present system is to classify the land and essentially that is all it does. Application to a specific action, e.g. a right-of-way, can only provide a very general assessment about the visual quality. The current system provides little insight into components of the landscape at the inventory stage which could influence the location and design, appropriate alternatives, and subsequent authorization. Consequently every action requires a detailed site specific inventory to address the proposed action. This is the most desirable approach, however in Alaska, access to the field or mobility in the field may not be possible or practical. Generally, only very large scale projects are afforded this luxury. Minor projects are not evaluated.

The development of descriptive methodology is obviously too general a topic but serves as the catalyst for a sequence of quantifiable secondary objectives. It is these objectives which varify or refute the goal of this total effort. While listed numerically, this is not a hierarchical priority.

1. Determine the most effective data collection procedure.
2. Determine what standards are appropriate for data collection and such standards must be commensurate with the scale of the effort and the land invloved.
3. The procedures and documentation shall be as free of special jargon as reasonably possible, and special terms subject to explanation be documented accordingly.
4. The resultant inventory shall have analytical flexibility.
5. The inventory shall be capable of hierarchial stratification.
6. The inventory methodology shall be evaluated for its application within two general frameworks,
   a. daily application for management decisions
   b. sufficient content for a quality planning document, URA/MFP.

These objectives are quite demanding and imply a rather intensive effort to meet them. Summer temporary landscape architects were employed. These individuals were landscape architecture professors or graduate

students. Collectively, they worked with existing staff in a "think-tank" capacity to hypothesize a workable methodology which could be applied during their summer tenure. These individuals collected the data and recorded and portrayed it in a form that would be most useful to satisfy objectives and Bureau needs. This report reflects this effort.

Subsequent efforts will be based upon conclusions with the ultimate goal being a manual supplement for visual resource management in Alaska.

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introduction

The need for management of the visual resource by Federal land managing agencies has existed for several decades in the United States. Although legislation prior to 1969 called for consideration of visual quality, the National Environmental Policy Act of 1969 was one of the first significant pieces of legislation to call for planning that assured the public of "Esthetically pleasing surroundings." (NEPA, 1969). Since many of the land management activities of the Bureau involve alteration of the landscape, it is especially important that BLM planning take the natural character and quality of the landscape into consideration.

Other sources of authority for development of the Bureau of Land Management's Visual Resource Management Program include: the Federal Land Policy and Management Act of 1976 (P.L. 94-579), the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87), the Clean Air Act Amendments of 1977 and the Outer Continental Shelf Lands Act. In addition, there are several other laws, statutes and orders that are relevant which indicate that there was considerable legislative mandate for development of a Visual Resource Management Program.

As a result of legislative mandate and public emphasis, the BLM began development of a comprehensive VRM system to address this need for consideration of the visual resource. The VRM program is intended for the preservation, enhancement and rehabilitation of the visual resource and management of the visual resource includes, among other things, inventory and analysis as well as determination of objectives or standards. (Stone, 1978, p.3). This information is then used along with other resource information in the land use planning process.

The BLM, then, has developed a VRM system to provide input into the planning process for management of the 350 million acres of public lands within their jurisdiction. As of July, 1980, 167 million acres or nearly half of this total land management responsibility was in Alaska.

The VRM system that was developed by BLM is appropriate for most of the BLM lands in the lower 48 states and is quite similar to the system used by the Forest Service. Basically the BLM system takes two different kinds of data, and analyzes them to arrive at a determination of visual resource management classes. The process involves three steps which are: preparation of a scenic quality inventory, determination of visual sensitivity levels, and delineation of distance zones.

To prepare a visual resource analysis of a specific site, a scenic quality inventory is first done (this is the first type of data mentioned above). The site is divided into units according to their scenic character and these units are rated against the physiographic province of which they are a part. These scenic quality ratings, based in part on subjective data, give a relative indication of the visual quality of the landscape and also suggest the diversity that exists within the area.

Next a determination of visual sensitivity levels is made for the site. This involves identifying viewer locations (key observation points or KOPs), delineating areas that can be seen from these locations and then determining sensitivity levels for these areas based on volume of use as well as the attitudes of users toward man-made landscape modifications. (For example, if the consensus is that man-made modifications of the landscape in a certain area are relatively unobjectionable and the volume of use is low, then the visual sensitivity of that area would be low).

The third step in the process involves determination of distance zones. Once the key observation points are established, designation of distance zones is more or less a mechanical process. Distance zones are determined for areas of high and medium sensitivity. Distance zones are designated as either foreground-middleground, background, or seldom seen as measured from the key observation points. Foreground-middleground is that area from the KOP out to the distance where texture and form of individual plants in the landscape is no longer readily discernible (usually 3-5 miles). The background, then, becomes the remaining area that can be seen from the KOP-out to about 15 miles. Seldom seen areas are areas that are more than 15 miles from KOPs or unseen for other reasons. (the backsides of mountains for example).

This approach is relatively effective and responsive to planning needs for Federal lands in the lower 48 states. In Alaska, because of the differences in both scale and use patterns, the process is not appropriate. Two of the three steps previously outlined no longer apply when the Alaska scale landscape is considered. In the lower 48 states, areas of federal land are most often measured in tens or hundreds of thousands of acres whereas in Alaska, the BLM planning units or subunits are measured in millions of acres.

Visual sensitivity level determination in the lower 48 states is appropriate but the approach breaks down quickly when applied to the Alaska landscape. Much of the federally-managed land in Alaska has access only from the air so there aren't easily identifiable key observation points and KOP's are critical to sensivity level determination using the current approach. Use levels in Alaska are considerably lower than in the lower 48 states so input on use volume and user attitude has less meaning. For these reasons, the present procedures for assigning visual sensitivity levels outlined in the BLM manual is not appropriate in Alaska.

Distance zone designation, the third step in the process, is also not appropriate for some of the same reasons. Distance zones are measured from KOP's and it was already mentioned that the concept of KOP's doesn't apply in Alaska. Since much of the BLM managed land in Alaska is seen from the air, viewing distance would be a continuous variable depending on the altitude of the aircraft. Distance zone determination, as outlined in the BLM manual, is not appropriate for Alaska either.

The options before the landscape architect were to use only the scenic quality variable in the three part system and exclude the remainder where situations cannot support that data need or to build an analytical

system reflective of Alaska and the variables which influence the decision making process. The latter option is the substance of this report.

Inventories compiled by the Bureau are analyzed for two primary functions; regional planning documents and case work. The planning documents may be the Management Framework Plan or a more area specific activity plan. Casework is generally associated with special or temporary use permits and the environmental and legal document required for authorization of the permit.

The new inventory system must identify demand elements to be effective. To achieve this, a brief analysis was made of a typical action causing a surface disturbance. Questions were then asked as to what data needs are essential before responsive decisions could be made. The following diagram reflects this thorough process.

INVENTORY REQUIREMENTS	EVALUATION OF PROPOSED ACTION
Visual Resource Management Classification Scenic Quality Visual Sensitivity Visual Acuity (distance zones)	Visitor Preference Scenic Preservation Development Priority
Landscape Composition Landform 1. Profiles 2. Ruggedness (surface texture) Waterform 1. Configurations 2. Extent Landcover 1. Vegetation Patterns 2. Vegetation height & mass 3. Barrenground.	Components of Landform Vegetation (and possible structure) present in landscape which can indicate visual tolerance of the landscape to sustain impacts of the proposed action. This also indicates what design measures might be appropriate to integrate project with the landscape.
Plant Ecology - Species Type - Community Composition - Micro Climatic Conditions - Successional Needs Slope and Aspect	Rehabilitation requirements indicating what measures should be taken to restore a disturbed site.[these are biological data elements dealing with micro ecosystems.]
Engineering Parameters Terrain Roughness Surface Stability Physical Barriers Geologic Hazards Intertie With Existing Systems	Physical and economic limitations which influence project design. [These are primarily physical science data elements dealing with soils, hydrology, and special site factors.]

This diagram indicates the complexity of a design decision where surface disturbances occur. Other resource concerns would have to be included depending upon any given situation. The present design decision process only involves the visual classification portion. Projects are evaluated with a contrast rating which is to indicate to management the need for site design. Experience has revealed that once a permit is issued, the Bureau has little opportunity to become involved in the design process.

Recognizing this problem, an analytical system which can provide management design parameters and stipulations for rehabilitation would be more effective step in the permit authorization process. Such a system would need to include all the data collection needs identified in the diagram.

This report will concentrate on the portion entitled landscape composition. The methodology is described in the next section--Process. The system is far from perfect, but it seems to provide a sound foundation on which to build.

process

Process combines background, methodology, and technical procedures necessary to develop the inventory. The inventory has been given certain parameters dictated by a primary planning effort which designates the size of the area to be inventoried. The subsequent planning document has certain goals which must be satisfied. In Alaska, mobility to and in the field creates additional parameters. Displaying mapped data for vast acreages generates still another factor. This effort tried to consider all aspects and formulate a system which allows the greatest flexibility and still meet the needs for the planning effort and hopefully be useful for routine casework.

BACKGROUND - VISUAL RESOURCE INVENTORIES (Scheele, 1980)

Documenting the visual attributes of a site is a well established early step in a sound professional approach to any planning or design project. It is, in fact, a key to idea development and decisions on how a site might be used. When visual values are integrated with other resource and social values, a comprehensive and useful planning approach can be mounted.

What exactly is a visual resource inventory? How is it created and how does it aid in understanding the character of the existing landscape? A brief review of the work of some leading investigators, related to inventories of sites of similar size or larger, will shed some light on these questions.

PHILLIP LEWIS, JR.

In the early 1960s, Professor Lewis was commissioned to identify the high quality recreational resources in the State of Wisconsin. This study was commissioned to enable the state to embark on an advance purchase program of sites of outstanding recreational value. Lewis conceived "outstanding recreational values" in visual terms and designed an inventory method which, among other things, mapped the physical components which tended to visually tie the landscape together. In his Wisconsin study, Lewis identified the elements of surface water and steep topography and their associated viewing opportunities as the key landscape structural elements. He proposed that it was the combination of these physical components which gave places in the Wisconsin landscape a distinct personality and which would become a highly demanded recreational settings (Wisconsin Department of Resource Development, 1963).

R. BURTON LITTON, JR.

In 1968 Professor Litton published "Forest Landscape Description and Inventories - A Basis for Land Planning and Design (Litton, 1968)." In it he identified six factors which affect scenic analysis and seven compositional types of landscapes. Litton focused on the compositional types as a means of describing the total landscape and as the organizational framework for a visual inventory. Composition by definition connotes

multiple parts or elements put together as whole scenes. As such, Litton's approach differs in style from Lewis' elemental approach but remains focused on the idea of identifying the structural components of the landscape, namely, whole compositions.

Litton's more recent work has also had an influence on this study. In "A Landscape Inventory Framework: Scenic Analysis of the Northern Great Plains: (1978), he establishes a hierarchaical system of landscape classification and the identifying factors of each level. The four part hierarchy is composed of the landscape continuity, province, unit and setting. The Yukon-Kuskokwim description was conducted at the continuity and province levels only.

In "Visual Vulnerability of Forest Landscapes," Litton (1974) develops a concept which is based on the "degree to which manmade changes might be seen in the landscape and their potential for degradation--in essence, the landscape's resistance or susceptibility to visual changes." This concept is one basis for assessing the effects of change proposals on the Unit landscape--the second purpose which data in this description aims to satisfy.

ERVIN ZUBE, et al.

Professor Zube and his colleagues published the "North Atlantic Regional Water Resource Study, Appendix N, Visual and Cultural Environment," (Research Planning and Design Assoc., 1970). In it they identified the juxtaposition of six landscape series and eight landscape units as a classification scheme for the New England landscape. The "series" were different classes of landform which were identified as the most dominant and enduring parts of the landscape. By extension they are recognized as its primary visual structural components. The visual pattern which results from the hand of man on this structural base lends each part of the landscape a distinct character or personality. By limiting the number of series and the number of units (land use pattern types) a useful set of landscape character types can be described in the inventory. This kind of organization becomes another efficient way of breaking the landscape into meaningful and describable parts.

BLM-VRM

The Bureau's Visual Resource Management Program has partially built its descriptive inventory process on the conceptual framework developed by the previously definted research work. Basically, the focus is placed on documenting the landscape's visually perceived natural structural components and cultural modifications. The natural components include the surface form of the land, the extent, color, and textural pattern of the vegetation, and the type and extent of the surface water pattern. A detailed, elemental narrative of these components, a selective assortment of photographic records which captures the essence of each type, maps, and other graphics form the information base. It is the various compositions of these natural components and the manmade pattern operating on each that results in one or a limited number of characteristic visual impression(s) of each landscape segment.

ALASKA NATURAL LANDSCAPES

Federal-State Land Use Planning Commission for Alaska
Commission Study 33 (Gordon and Shaine, 1978)

The Gordon and Shaine report used essentially the Scenic Quality Evaluation portion of the Bureau's Visual Resource Management system. From this, Alaska's landscapes were catagorized and qualified. This effort provided a general descriptive inventory of the State at 1:2,500,000 scale.

Second, descriptions were made of superlative landscapes in Alaska. These superlative landscapes are of two kinds; Visual units of a single character type which stand out from a statewide perspective on specified criteria; and scenic complexes, where a diversity of outstanding visual units are in proximity. Wahrhaftig's physiographic province map was used to regionalize these landscapes and the Ecosystems map of Alaska, 1973, was used to support landcover diversity. The result is a single set of regional divisions and selected subdivisions which effectively detineate the regional visual similarities and differences in Alaska.

METHODOLOGY

The landscape when viewed from the air exhibits surface variations which appear as a mosaic of patterns. These patterns are combinations of water and landforms, landcover, and color. These forms can be considered as compositional elements wherin spaces are created, edges are defined and blocks of homogeneous forms can be identified. This perception holds true for the ground observer; however, distinction can be much more difficult. These composition of forms become the building blocks of this descriptive inventory for Alaska.

The landscape composition will be divided into components which can be readily identified. These components are described and mapped individually in order to represent their inherent contribution to the landscape composition. Upon analysis, the landscape architect or planner can overlay these components to identify the compositional patterns. In the case of a project, the component overlays will signify the component most affected, the compositional patterns affected and indicate to the designer how to most effectively integrate the project into the landscape.

Managers, through this same process can determine areas of greatest impact and be able to suggest other locations or routes which would have less impact on the visual landscape.

In order to develop this system, the landscape architects had to rely upon published data sources to identify land and waterforms (USGS Topographic Maps) and vegetation mapping (Regional profiles 1976, Terrestrial Vegetation, ALASKA STATE LAND USE PLANNING COMMISSION). This information was verified in the field to the extent possible with inclement weather and limited travel funds. Other sources which aided the landscape architects are found in Appendix A. Landcover color which was the relative or representative color was identified for each characteristic landcover type. The Munsell color chart was used as the basis for the descriptive documentation.

Landforms description began with C. Wahrhaftig's Physiographic Provinces of Alaska. Landform profiles were described and dramatic landforms identified. Waterforms would identify locations of major water features such as ponds, lakes, and predominently wet areas which could be wet tundra. Moving water was mapped by channel types, either braided, meander, or fixed. As a final bit of information, atypical areas were identified. These could be unique landforms, sand dunes, steep canyons etc.

This consitutes the basic methodology. The technical procedures portion will be retained until such time that a manual supplement is prepared. A criteque of this methodology can be found in the "Conclusion" section of this report.

application

Study Area

The Northwest Planning Unit is located in the Arctic-Kobuk Resource Area in the Fairbanks District of the Alaska State Office, Bureau of Land Management. The entire planning unit is about 42,500,000 acres in size but only about 15 million acres of that total is actually BLM managed land, and this land is located in six fairly distinct parcels within the planning unit. Boundaries were drawn around these parcels and six planning subunits were formed which are a more workable size for planning purposes. These subunits range in size from 825,000 acres to 6,250,000 acres and include a great deal of visual variety according to landform, waterform and landcover color.

northwest planning unit - approx. sizes (in 000's of acres)

sub-unit	size	adjacent lands incl.	total	BLM managed lands
bendeleben mtns.	2,640	—	2,640	1,872
imuruk basin	1,441	—	1,441	1,093
kukpuk	5,129	32	5,161	1,904
selawik/nulato hills	3,823	2,592	6,415	6,275
shekluk shuk	908	—	908	908
squirrel/noatak river	3,261	—	3,261	2,395
totals	17,202	2,624	19,826	14,447

Because the Northwest Planning Unit encompasses nearly 15 million acres of land under BLM management and a three month period was allocated for completion of the initial inventory, it was decided that field work would be done from the air. Since a considerable amount of time was devoted to the development of a set of base maps for the six planning subunits which would be of value in further planning efforts, the scope of the summer project for the Northwest Planning Unit was essentially limited to an inventory of the visual resource.

The approach chosen for the project consisted of preparation of base maps, collection of inventory information, presentation of inventory information, and analysis. The base map preparation involved determination of exact boundaries of subunits and then delineation of these boundaries on USGS quad sheets (scale 1:250,000). These were then arranged on sheets so that each subunit base map was on a 32" by 40" base sheet. Collection of inventory information involved gathering information both from existing sources (USGS,SCS, Wahrhaftig, etc.) and from field surveys. In this case, field data was collected primarily from low level flights over the subunits to photograph and record information on landform, waterform and vegetation. Presentation of this information consisted of preparation of a series of information overlays on each of the subunit base maps as well as preparation of supportive text and documentation. Analysis, a subsequent section, was undertaken to a limited extent in an attempt to suggest a direction for continuation of this planning effort.

Limitations of this planning effort were largely a result of the amount of time available. A considerable amount of time was spent initially developing base maps and locating sources of resource data. This limited the amount of time available for the actual inventory. For a more detailed visual resource inventory, it is recommended that the subunits be considered individually and that a considerable amount of field work be scheduled in the process. Emphasis should be placed on coordination with the field and resource personnel so that the product(s) of the effort are in a form meaningful and useful to all.

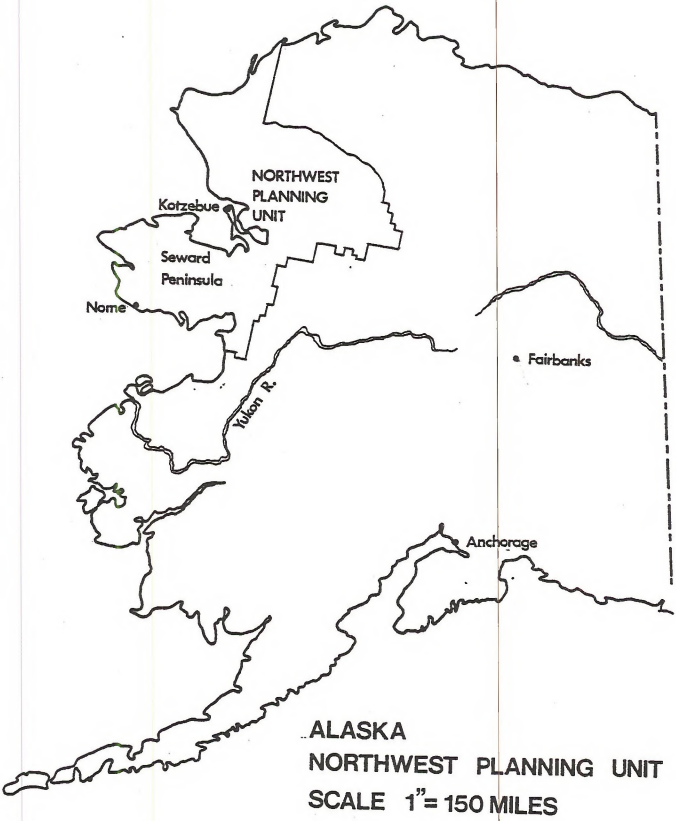
There were two major limitations to this approach which have already been mentioned. First of all, most of the published source material available was done at a smaller scale than our base map scale of 1:250,000, so this information had to be reduced and then adjusted. The accuracy of the inventory was limited, then, by the accuracy of the source data available at the time. The second limitation was a result of the amount of time available for field work. More time for field work would have allowed field checking of published information, more accurate and detailed landcover color information, and an overall increase in level of accuracy of the inventory.

The following text contains inventory features and how each was derived. Each subunit has the information plotted. The reader is encouraged to have the subunit maps and overlays available when they read this text.

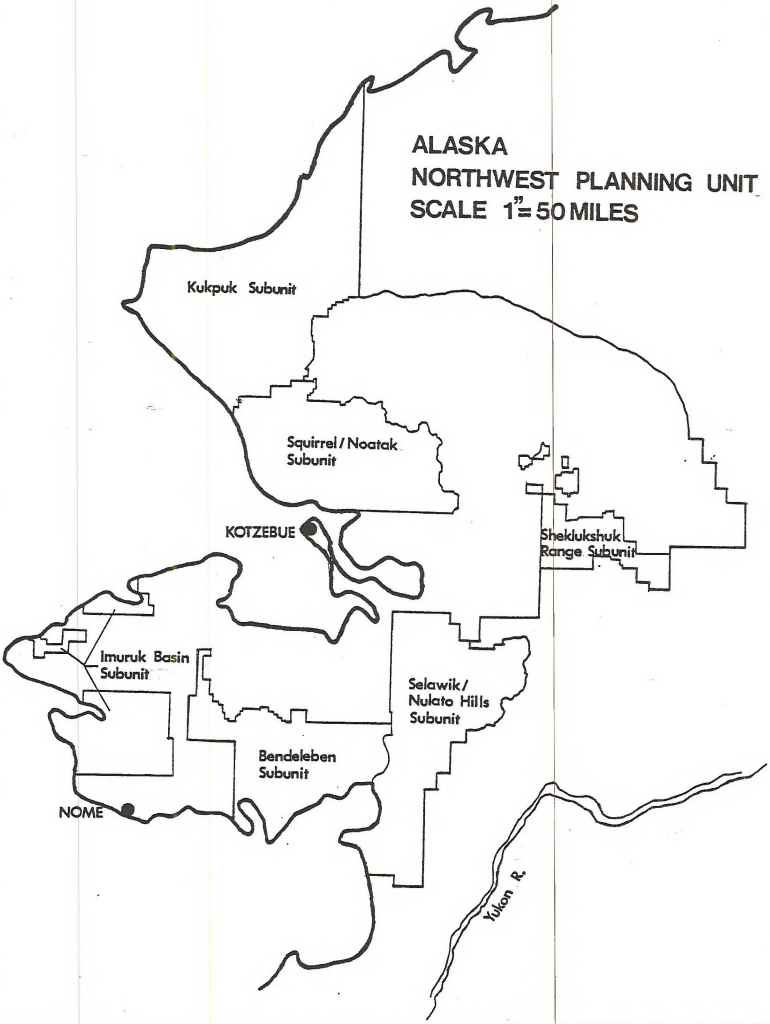
Landforms

The State of Alaska is located on the Great Northwestern Peninsula of North America. The landform of Alaska is primarily mountainous or hilly with broad plains. Clyde Wahrhaftig, in his report classifying landforms in Alaska (Wahrhaftig, 1965), divided the state into three divisions consistent with Fenneman's divisions of the United States (Fenneman, 1946). These divisions, which describe the major physiographic features of Alaska, are the Rocky Mountain System, the Intermontane Plateaus and the Pacific Mountain System.

Wahrhaftig further breaks down these divisions into physiographic provinces, of which there are twelve in the state. These twelve provinces



ALASKA
NORTHWEST PLANNING UNIT
SCALE 1"= 150 MILES


ALASKA
NORTHWEST PLANNING UNIT
SCALE 1" = 50 MILES
Kukpuk Subunit
Squirrel / Noatak Subunit
KOTZEBUE
Shekluksuk Range Subunit
Imuruk Basin Subunit
Selawik / Nulato Hills Subunit
Bendeleben Subunit
NOME
Yukon R.

are divided even further so that there are sixty units of physiographic division for Alaska. For the purpose of this report, the smallest units are not appropriate because of the mapping limitations of the small scale base maps. The physiographic divisions and provinces, however, along with another categorization used by Wahrhaftig relating to visual character, do provide meaningful input into a visual inventory.

The twelve physiographic provinces are each more or less homogeneous topographically and distinct in appearance from the adjacent provinces. Boundaries of the provinces are located where changes in physical (visual) character occur. Of these twelve physiographic provinces, four are represented in the northwest planning unit. These provinces are the Arctic Foothills, the Arctic Mountains, Western Alaska and the Seward Peninsula.

For this study, these provinces will be broken down into divisions which relate more to visual character. These landform divisions, also identified by Wahrhaftig (1965) are more appropriate at the planning unit scale. These landform types are: extremely high rugged mountains, moderately high rugged mountains, low gently rolling mountains, highlands with rolling togography and gentle slopes, and plains and lowlands.

A brief description of the physiographic provinces would be helpful at this point to explain the landform divisions used in the inventory and analysis. Each physiographic province, as mentioned previously, can be identified as being more or less homogeneous topographically and visually different from adjacent provinces.

The Arctic Foothills Province is located on the northern slope of the Brooks Range and is made up of rolling plateaus and low mountains. These foothills range in altitude from 600 feet to 3500 feet above sea level. Characteristic landforms include broad ridges and gently undulating tundra plains. The entire province is underlain by permafrost.

The Arctic Mountains Province is basically the Brooks Range and is made up of the De Long Mountains, The Baird Mountains, the Ambler/ Chandalar Ridge and lowlands, the Central and Eastern Brooks Range, and the Noatak lowlands. This province consists of mountains and hills varying considerably in ruggedness and the elevation varies from just a few feet above sea level in the lowlands to more than 8,000 feet in the central and eastern Brooks Range.

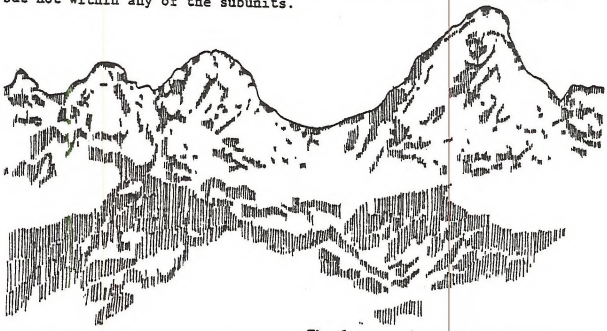
The Western Alaska Province extends roughly from Central Alaska westward to the peninsulas. This province is a combination of uplands and lowlands ranging in elevation from sea level to over 4,000 feet above sea level.

The last province represented in the Northwest Planning unit, and the only one entirely contained within the unit, is the Seward Peninsula Province. This province includes extensive uplands, isolated groups of mountains, coastal lowlands and interior basins. Elevations in the Seward Peninsula range from sea level to nearly 5,000 feet. The entire province is underlain by permafrost.

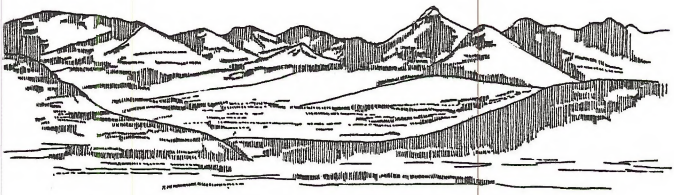
Landform

From this brief description, it is apparent that a great deal of variety exists within each province. The Western Alaska Province, for example, is further divided into 16 sections to address differences in physiographic characteristics and, consequently, visual character. These sections were not felt to be as descriptive visually as the landform divisions so the landfrom divisions were used to inventory the landform patterns for the Northwest Planning unit. These landforms follow the unit boundaries but group these units together when their visual characters are similar.

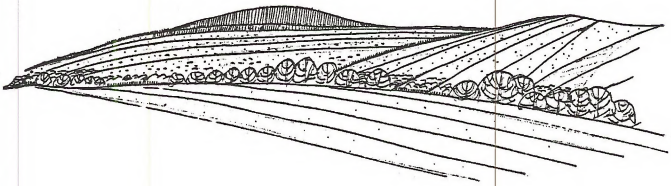
As mentioned previously, four landform types are found in the northwest planning unit. The moderately high rugged mountains are represented by the central Brooks Range. This landform category is generally from 2,700 to 3,600 feet in elevation and is found within the planning unit but not within any of the subunits.



The low gently rolling mountains are fairly common in the northwest planning unit and are typically 900 to 2,700 feet above sea level. Examples of this landform are the De Long Mountains, the Baird Mountains, the Kaltag Mountains and the Bendeleben Mountains.



The third category is highlands with gently rolling topography and this landform type is also common. These areas are from 150 to 900 feet in elevation and examples are Nulato hills and Mulgrave Hills as well as most of the Seward Peninsula.



The fourth category, plains and lowlands, is represented in most of the major river valleys as the coastal lowlands and is most often less than 150 feet above sea level.

The source of this landform information is Wahrhaftig's "Physiographic Divisions of Alaska" (Wahrhaftig, 1965). Plate 1 of the paper is a map showing these divisions at a scale of 1:2,500,000. This information was transferred to an intermediate scale of 1:1000,000 and then finally enlarged to a scale of 1:250,000 and shown on the USGS topographic maps. Boundaries of the areas were adjusted when transferred to the 1:250,000 scale to be consistent with topographic detail.

Landcover

Vegetation has a direct influence on the visibility of management activities within the Northwest Planning Unit. Low or open vegetation has no screening potential and most management activities are in full view. Tall, dense vegetation may screen most examples of carefully planned activities, but the swath that must be cut through the vegetation may itself become a visual impact. Diversified vegetation types have the highest visual absorption capability because they both screen activities and enable removal of vegetation so that the changes appear to be part of the pre-existing natural pattern.

Vegetation in the Northwest Planning Unit is composed of eight broadly defined plant communities which include; moist tundra, alpine tundra, wet tundra, upland spruce-hardwood forest, bottom land spruce-poplar forest, lowland spruce-hardwood forest, high brush, and low brush muskeg bog. (Spetzman 1963)

Descriptions of plant communities are based on the map, "major Ecosystems of Alaska", published by The Joint Federal State Land Use Planning Commission for Alaska (1973).

At the present time vegetation types and actual plant locations are broadly defined and delineated to 1 inch = 40 miles. The Ecosystem map was prepared by Spetzman in 1963.

Together the inventory maps were studied and, by combining appropriate data, five visually distinct vegetation boundaries were prevalent. The groups were:

- Mountain Tundra/Exposed Bedrock
- Bog/Wet Tundra
- Lowland Tundra
- Spruce River Basin Poplar Forest
- Spruce Hardwood

A combined vegetation and land cover color map for the Northwest Planning Unit was designed using the following procedure:

(1) Data from each source was grouped into visually distinctive categories and modified as appropriate.

(2) The modified categories were field checked through aerial reconnaissance and keyed to a color chip from the Munsell Color Charts for Plant Tissues.

(3) The grouped vegetation and land cover color data was enlarged to the base map scale of 1:250,000 together to produce the composite inventory vegetation overlay.

Table One illustrates how the Ecosystems were visually grouped.

TABLE 1 VISUALLY GROUPED VEGETATION

GROUPED VEGETATION	VEGETATION TYPES
MOUNTAIN TUNDRA/ EXPOSED BEDROCK	ALPINE TUNDRA EXPOSED BEDROCK
LOWLAND TUNDRA	MOIST TUNDRA
BOG/WET TUNDRA	MOSKEG BOG WET TUNDRA
SPRUCE/RIVER BASIN POPLAR FOREST	BOTTOMLAND SPRUCE POPLAR FOREST
SPRUCE HARDWOOD FOREST	LOWLAND SPRUCE HARDWOOD FOREST. UPLAND SPRUCE HARDWOOD FOREST

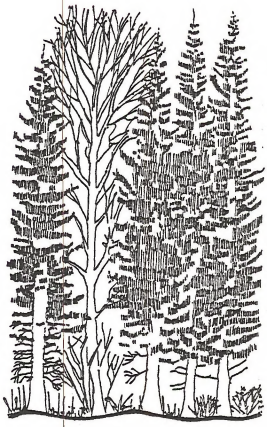
Mountain Tundra/Exposed Bedrock is characteristically found within moderately high, rugged mountain areas. The species generally are lichens, blueberry, and crowberry with the exposed, windswept areas pioneered by the lichens, lupine, aster, and cinquefoil. The soils in these areas are usually shallow silt overlaying very gravelly loam. Bare rock and stony rubble are also common.

Bog/Wet Tundra is characterized by almost continuous cover of grasses and sedges rooted in mosses and lichens. On slightly raised ridges dwarf shrubs may be found, while in standing water rooted aquatic plants such as horse-tail, pondweed, and bur reed are found.

Lowland Tundra is characterized by a wide variety of low-growing shrubs herbs, grasses, and sedges rooted in a continuous mat of mosses and lichens. This habitat type is very extensive within the Northwest Planning Unit. Cotton grass may be most obvious in depressions, and the abundant grasses are accented by numerous colorful flowers during summer.

MOUNTAIN TUNDRA/
EXPOSED BEDROCK

SPRUCE RIVER BASIN POPLAR FOREST



SPRUCE HARDWOOD FOREST

Spruce/River Basin Poplar forest habitat is characterized by tall stands of white spruce with balsom poplar. The understory includes high and low shrubs and a layer of ferns, mosses, and lichens.

Spruce Hardwood forest is characterized in some areas by extensive pure stands of black spruce and in other areas by black spruce along with tamarack, birch, aspen and poplar. Commonly black spruce is found on northern exposures and poorly drained flat areas. White spruce with scattered birch or aspen is commonly found on moderate south-facing slopes.

Vegetation color is one landscape characteristic and is considered an element of the landscape. Through aerial reconnaissance the vegetation groups were keyed to a color chip from the Munsell Color Charts for Plant Tissues. Table 2 illustrates how the colors were keyed to the vegetation groups.

TABLE 2
VEGETATION GROUPED BY VISUAL CHARACTER & COLOR

VEGETATION TYPES		COLOR DESIGNATION	MUNSELL CODE	#KCC -NBS*
EB/MT	MOUNTAIN TUNDRA EXPOSED BEDROCK	PALE YELLOW-GRAY YELLOW/GRAY YELLOW YELLOW GRAY	5Y 8/4 - 2.5GY 8/2	#89-#93
LT	LOWLAND TUNDRA	LIGHT YELLOW GREEN	2.5GY 8/6	#119
B/WT	BOG/WET TUNDRA	MEDIUM YELLOW	5Y 8/6	#87
SPF	SPRUCE/RIVER BASIN POPLAR FOR.	STRONG YELLOW GR. MODERATE OLIVE GR	5GY 7/8- 7.5GY 4/4	#117-#125
SHF	SPRUCE HARDWOOD FOREST	MEDIUM OLIVE	7.5GY 4/4	#107

* SEE REFERENCE

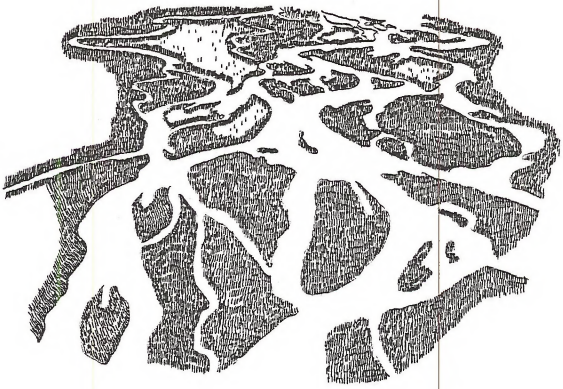
It has become apparent that a new unified statewide system for classifying vegetation in Alaska is needed. Currently a new hierarchial system is being developed by Leslie A. Viereck and C. T. Dyrness (Viereck and Dyrness, 1980) which could greatly improve vegetation classification for future studies. At the present time the Regional Profile for the Northwest Planning Unit contains the only available vegetation resource map. It was beyond the scope of this study to do a special interpretation of the Visual Absorption Capability of vegetation from aerial photography.

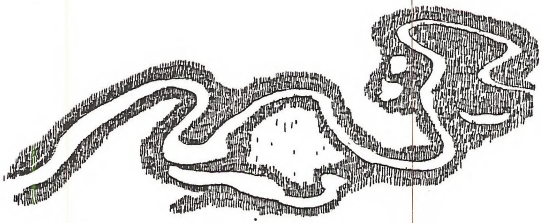
Waterform

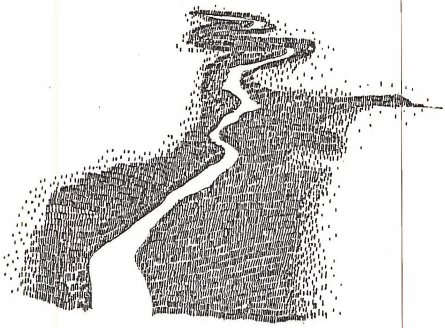
Water in the Northwest Planning Region is a major element in the visual landscape. In an attempt to categorize waterform visually, several elements were considered. Among these were location of major water features (such as lakes, rivers and large areas of standing water) and classification or river channel types.

Within the Northwestern Region, there are only five lakes with a surface area of over ten square miles an only one of these lakes is within a planning subunit. This lake is Imuruk Basin and it is a tidal basin on the Southwestern coast of the Seward Peninsula in the Imuruk Basin subunit.

There are several major rivers that pass through the planning subunits. For the purpose of this inventory, rivers were considered major if they were classified as major by the U.S. Army Corps of Engineers in their Interim Report Number 6 (1967) based on estimated average annual flow, size of drainage area and length of main stream. Major rivers were located and then classified according to channel type as either meander, fixed or braided channel. These categories are similar to categories assigned to river channels in a Corps of Engineers' report of Upper Susitna River (Jones and Jones, March 1975).







These rivers are identified by channel type on the individual subunit base maps. The channel type is an indication of the visual character of the river and may be helpful later in considering visual vulnerability of these subunits.

The following is a grouping of major rivers by subunit:

Subunit	River
Bendeleben Mountains	Fish River Koyuk River Kuzitrin River Tubutulik River
Imuruk Basin	Agiapuk River Mint River Nuluk River Pinguk River Sanaguich River Serpentine River
Kukput	Kivalina River Kukpuk River
Selawik/Nulato Hills	Buckland River Inglutalik River Kateel River North River Shaktoolik River Tagagawik River Unalakleet River Ungalik River
Shekluksh uk Range	Pick River
Squirrel/Noatak River	Agashashok River Noatak River North River Squirrel River

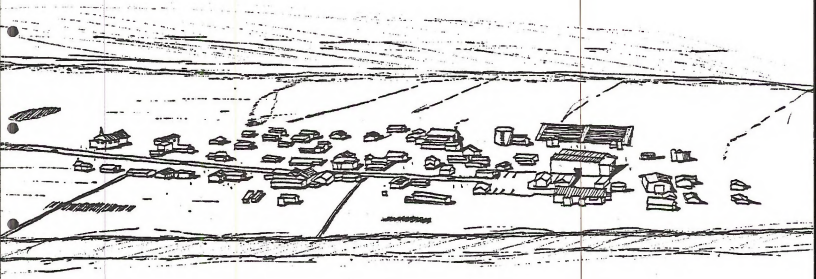
The final criteria considered under waterform is location of large areas of standing water especially groupings of tundra lakes. These areas are large, low-lying wet areas that have a definite visual character of their own. Examples of this type of area would be the Pah River Flat, McCartley's Marsh or the large wet area east of the Noatak River. These areas are all identified individually on the inventory overlays.

Cultural Influences

Existing cultural influences in the landscape are potentially a significant visual element and should be taken into consideration in a visual inventory. In the Northwest Planning Unit, cultural influences are relatively minor but possibly important in terms of influence so they were inventoried. Cultural influences that were identified were:

villages
mines
roads
utility corridors
air strips

These elements were located on the USGS quad sheets and identified on overlays for each subunit. The accuracy of the information was limited by the date of the particular USGS map and some had not been revised for more than twenty years. It is possible, or even probable, that there are existing cultural influences in the subunit that do not appear on the overlays.



analysis

The principles to be applied in determining the physical capability of the land to absorb impacts appears to have general applicability to land use planning throughout Alaska. Objectives may differ, but the fundamental knowledge of how certain units of land naturally function within an ecosystem and their tolerance to surface disturbances by man's activities should be clearly understood before making decisions regarding land use.

For the purposes of this study, visual vulnerability was used as the principle measure of capability. Land capability is in turn defined as the level of use an area can tolerate without sustaining permanent damage through excessive erosion and other causes. While capability classes were not developed as such, the analysis indicates what might be appropriate or inappropriate areas of surface disturbance. The landscape composition as described in the inventory, both verbally and graphically, serves as the analysis components.

The next step in the analysis is to evaluate the common projects or actions the Bureau can expect on the public lands. These disturbances were divided into three groups so they could be considered individually or collectively:

Linear disturbances
- utility corridors
- trails
- seismic test lines
- survey lines
- roads

Point disturbances
- mines
- power plants
- wells
- landing strips

Area disturbances
- grouped placer mines
- reservoirs
- strip mines
- villages
- fire management areas

These surface disturbances should first be described as completely as possible so that the reader will have a thorough mental image of each one. Description should be in both graphic and narrative form.

Once these surface disturbances are described, the next problem is to relate these disturbances to the visual elements and discuss the relationships in terms of impact. These relationships can be discussed at a general level (by groups) or a specific level (individual disturbances considered).

l Vulnerability Matrix

;e of the potential complexity of these relationships, a matrix i be used to simplify presentation. Once this matrix is completed, nation can be applied to the base maps to arrive at a measure of l vulnerability. At the simplest level, the matrix would include ›llowing elements:

	landform	waterform	landcover
disturbances			
listurbances			
: disturbances			

ı the matrix grid would be a discussion of how that particular ıation of visual element and surface disturbance would affect the l vulnerability of the area for planning and management. How point :bances, for example, would affect the landform. Information might ›e included here relating to possible mitigating actions that could ten to minimize the impacts if a particular type of surface disturis inevitable. This should include not only mention of negative :s of a surface disturbance but also any positive effects. At this , the matrix begins to be more useful as it addresses issues more :ly related to the decision making needs. It should be recognized, information in this matrix is much more subjective than the inventory ınd should be used cautiously.

:xt level of information that could be provided in matrix form les breaking the visual elements down into their component parts:

	LANDFORM				LANDCOVER					WATERFORM				
	lowlands	highlands	low mtns.	rugged mtns.	low tundra	wet tundra	mtn. tundra	spruce/hwd.	spruce/poplar	standing wat.	lakes	fixed channel	braided channel	meandering chan.
T URBANCES														
A URBANCES														
AR TURBANCES														

The next step in the progression of information would be a more detailed matrix with specific surface disturbances and visual elements indicated. This step would take a considerable amount of additional time to complete but would provide information directly usable by the landscape architect in making planning decisions. At this level, the matrix would include the following:

SURFACE DISTURBANCE \ VISUAL ELEMENTS		LANDFORM				LANDCOVER					WATER FORM				
		plains & lowlands	highlands w/ gently rolling, top-sloping	low mountains, gently rolling	moderately high rugged mountains	lowland tundra	mountain tundra / exposed bedrock	bog/wet tundra	spruce/hardwood	spruce / mixed basin poplar	large areas, standing water	lakes	river channel, fixed	river channel, braided	river channel, meandering
POINT	mines														
	power plants														
	wells														
	landing strips														
AREA	reservoirs														
	strip mines														
	group placer mines														
	fire management														
	villages														
LINEAR	seismic-test lines														
	survey lines														
	roads														
	utility corridors														
	pipelines														
	cat trails														

In this grid as in the previous grid, information would be placed as to how that particular combination of surface disturbance and visual element affect the visual vulnerability. In this more detailed matrix, more should be included relating to possible mitigating measures. (If a road is placed through the plains and lowlands, for example, what actions might be taken to minimize the visual impact.)

Finally, in this grid, each of these visual elements should be evalvated in terms of its sensitivity as far as each surface disturbance is concerned.

acceptable but requires site planning			not acceptable
low	medium	high	alternatives must be selected

visual sensitivity

For example, low mountains with gently rolling topography may only be moderately sensitive visually as far as road location is concerned. This rating should be reflected in the matrix grid. Although this is an empherical evaluation, it will give the decision maker an idea of the relative sensitivity of each element.

Visual Vulnerability Map

Although the Visual Vulnerability Matrix will probably be the most useful form of information for the planner or decision maker, it is sometimes desirable to have a map presentation of information for reference. The information in the matrix could not realistically be presented in map form since that would involve preparation of as many as 210 overlays (15 X 14) for each planning sub-unit. Once a certain surface disturbance were being considered, however, overlays could be prepared for that disturbance and the relevant visual elements.

As an example of the type of information that might be appropriate at this level, a sample matrix was prepared. Comments in the matrix grid cells are not intended to be complete but to give an idea of the kinds of information that could be presented.

The matrix, then presents the types of information that might be useful for management decisions involving land uses. This information could be applied to specific overlays once a surface disturbance is proposed to aid in the decision-making process. For example, if a utility corridor was proposed through the Bendeleben Mountains Planning Sub-unit, the manager could refer to the linear disturbances cells in the matris. These cells would contain relevant information concerning the effects a utility corridor would have on each of the visual elements.

	LANDFORM				LAND COVER				
	PLAINS AND LOWLANDS	HIGHLANDS W/ GENTLY ROLLING TOP	LOW MTNS., GENTLY ROLLING	MODERATELY HIGH, RUGGED MTNS.	LOWLAND TUNDRA	BOG/ WET TUNDRA	SPRUCE/ HARDWOOD	SPRUCE/RIVER BASIN POPLAR	MOUNTAIN TUNDRA/ EXPOSED BEDROCK
POINT AND AREA DISTURBANCES	large open and relatively flat area open vistas, lack of visual variety, new element will tend to dominate, view vastness of scale difficult to comprehend.	enough relief variation to absorb some impacts and provide some screening, location and design of disturbances critical to minimize impacts.	less variety and diversity visually than rolling mountains location of disturbances important (below horizons, avoid steep slopes) with multiplying as background and colors selected to blend with natural surroundings, impacts can be minimized.	high diversity and visual variety. proper placement of disturbances important (avoid ridges and steep slopes) high erosion potential on steep slopes. sharp and color lines of landform must be considered in design of disturbance.	visual variety and diversity low texture relatively fine and lack of screening potential.	visual variety and diversity low texture fine, no screening for disturbances.	moderate visual diversity and color variety, dominantly of vegetative cover makes disturbances more noticeable. relatively coarse texture. cleared areas stand out usually. impacts from disturbances related to density, percent crown cover construction techniques, color of disturbance.	high species diversity and color variety, plant and area disturbances blend more easily with surroundings.	visual variety and diversity low texture fine, low ability to usually absorb point and area disturbances high due to lack of vegetative cover. also high erosion potential.
LINEAR DISTURBANCES	lack of topographic variety makes disturbances more visible - often no major element to focus on so linear disturbance becomes focus. linear disturbance more consistent with forms and shapes of this element than the other landform types. location along edge would help to minimize impact of disturbances as well as respecting natural forms in design of disturbances.	similar in line and form to low mtns but less extreme. undulating land forms will provide some screening for disturbances as well as breaking up continuity of linear disturbances placement and design important in minimizing impact.	scale not as vast as with plains and lowlands. forms less extreme than rugged mtns. so limited elements less inconsistent topographic variation still enough to soften effects of disturbance. curvilinear landforms more compatible, disturbances can follow valley ways. placement & design important.	sharp angular abrupt lines. high visual variety. continuity of linear disturbances makes them appear inconsistent and unnatural. continuity broken up somewhat by topographic variation but ridges must be crossed and skyline edge is usually dominant alignment and design important.	linear disturbance inconsistent with forms and lines natural to tundra linear disturbances visible for great distances. disturbances more noticeable due to lack of screening. color contrast potentially high between tundra and disturbance. long regeneration period.	same as for lowland tundra. more visible...construction could be more damaging visually due to water content.	because of coarse texture, linear disturbances would be more noticeable where clearing is required. due to large in continuity of vegetative cover, this would tend to focus attention on disturbance. attention to color, alignment of disturbance would lessen impact	more species diversity and color variety than spruce/hardwood so ability to absorb visual impacts much better. slightly greater otherwise, spruce/hardwood dis-cussion applies.	similar to lowland tundra but less diversity and longer regeneration period. less variety than other two tundra types so construction possibly less impacting visually.

A general vulnerability map for each sub-unit could be prepared that would be useful as a starting point for planning purposes. This map would be based on interpretation of three overlays. The overlays would be prepared for landform, waterform and landcover (cultural influences in the Northwest Planning Unit were not considered significant). Each of the landform categories, for example, would be rated as to its visual sensitivity to each of the the three general surface disturbances. (Plains and lowlands might be highly sensitive to linear disturbances but only moderately sensitive to point disturbances).

conclusions

Management decisions in land-use planning, and in routine casework can be made with the recognition that their physical results will alter the visual landscape. Certain characteristics can help predict the landscape's vulnerability or resistance to such man-made visual impacts as roads, transmission and pipelines, and surface mining. The landscape architect must recognize (a) landscape compositional types, (b) sensitive areas and locations, and (c) outside influences and inherent effects such as orientation, climate, season, slope, and soil and vegetation surfaces. This report concentrated on the landscape componsitional aspects of Alaska's public lands. As stated in the introduction, this factor serves as one of four primary factors essential to project analysis and design. As a planning inventory, the data can be analyzed to determine compositional complexities or diversities which can be useful in indicating, in a general way, which landscapes are more tolerant to development and which ones are more visually vulnerable. For case work, a general evaluation can be made. Actual surface disturbing projects will still require a site inspection, but a better field evaluation is possible after first reviewing the inventory.

A Critique

The inventory may seem somewhat brief in content. The reason is because the appropriate level of detail shoud be commensurate with the graphic representation. The level of detail can be expanded by going to a larger scale thereby providing a refinement in data.

The analysis based upon what might be considered a typical surface disturbing activity also is brief. This is a function of a nonspecific activity and a general level of inventory.

The point of this discussion is not the level of detail presented but whether the system functions and can function at whatever level of detail is appropriate. Finally, can this information be recorded in hierarchial levels which can be integrated directly with other resource data? Unfortunately, the short summer session would not permit studying hierarcherial inventory levels. Future efforts may explore this concept.

What worked well and what aspects of this proposed methodology fell short of its goal? Inasmuch as the landscape architects have not had an opportunity to use this inventory and analysis procedure, it is premature to make any early judgements of its utility. The data collection process, however, revealed a few inconsistances.

The initial scale of the inventory can only yield so much inventory data based upon the secondary sources of information used. At 1:250,000 scale, vegetation information is inconsistant with terrain information. Many of the compositional patterns anticipated were not evident when the overlays were combined. At best, only very general associations were produced. This is attributed to the adapting of 1:1,000,000 scale vegetation patterns to 1:250,000 scale landforms. Had the landcover detail been collected at the same scale, the composition elements would have been better identified. Appendix B provides a chart of mapping scale relationships.

Water form as a determining factor serves largely to reinforce landcover and landform. As an individual component, it appears weak. The opportunity to use this component in evaluating a specific may provide better results.

Landcover color, while relatively easy to obtain presents still another question. The color evaluation is entirely contingent upon perception variables, e.g. season, time of day, sun angle, weather, and distortion of aircraft window material. With so many variables, how can this component be useful? At best, this information would provide the project designer or manager with an appropriate color stipulation for all permanent structures places in the landscape.

Future Development

Five primary areas are suggested for further study, (1) application of the inventory in planning efforts and in casework, (2) refinement of the analysis process with specific standards developed for visual vulnerability, (3) use of applied technology to enhance data collection, (4) systematic cataloging of data for integration with other resource data, and (5) developing a complete inventory profile (including plant ecology and engineering variables) which will address "plans of operation" and right-of-way issues with a level of detail to provide articulate provisions in use authorizations and environmental assessment.

Future efforts will have to be planned and budgeted. Priorities for the efforts will be based upon demand. The ultimate goal is to develop a cohesive data colection and analysis system which will provide sufficient detail for landscape architects, planners, and managers to recommend and/or design projects which are integrated into the landscape with the least adverse visual and environmental impact regardless of whether it is frequently seen or not.

appendix

Appendix A

Scale and Quality of Existing Published Data Sources

Giving partial definition to resource values through a mapping process is an important purpose of a descriptive inventory. However, most inventories are constrained by the existence and scale of published data even though there are some times when original data is created. Often limited field verification of existing data is the most that can be hoped for. This was the situation with this study. The following data were identified as relevant to the descriptive inventory.

Vegetation Information

1. Potential Natural Vegetation of Alaska - 1:7,500,000: This map was authored by A. W. Kuchler in 1966 and shows the plant community boundaries of the "vegetation that would exist today if man were removed from the scene and if the plant succession after his removal were telescoped into a single moment."

2. Major Ecosystems of Alaska - 1:2,500,000: This map and description was compiled by the Joint Federal/State Land Use Planning commission in July 1973. Twelve land based and seven marine based ecosystems are identified, described by major components, and mapped.

3. Regional Profiles, 1976: The Terrestrial Vegetation Sections of the Northwest, Yukon, and Southwest Regional Profiles were consulted for the mapped community patterns and the community makeup and types. The mapped community patterns are at a scale of slightly less than 1:1,000,000. These have been aggregated from original data by Spetzman (1963) and Viereck and Little (1972).

4. Spetzman, 1963: The Alaska Resources Library has original vegetation maps at 1:250,000 scale on file. These are essentially color coded USGS topographic maps which identify nine classes of dominant trees, shrubs, and grasses. The smallest map increment is approximatly one square mile at the map scale. Most patterns are considerably larger.

Landform Information

1. Classes of Land-Surface Form - 1:7,500,000: This map was authored by E. H. Hammond in 1964 and is particularly useful and directly applicable in that it is based on the "visual image of the surface form" and "broadly suggestive of potential land use." Hammond's original map at 1:5,000,000 was based on an empirical analysis of the land surface.

2. Physiographic Divisions of Alaska - 1:2,500,000; This map and descriptive text was authored by Clyde Wahrhaftig in 1965. Wahrhaftig also used physical apprarance of the topography as

a basis for delineating one division from another. This pattern is then modified by geologic structure which may or may not have a significant visual attribute. It is for this reason that Wharhaftig's classification, even though focussed specifically on Alaska, was judged to be slightly less useful to a strictly visual inventory than that of Hammond's. Wharhaftig's detailed narrative descriptions were very useful however.

3. Topographic Maps - 1:250,000 and 1:63,360: The USGS topographic map coverage with 200' and 50' contour intervals respectively is complete for the entire study area.

Drainage Information

1. "Upper Susitna River Alaska: An Inventory and Evaluation of the Environmental, Aesthetic, and Recreational Resources." This study was prepared by Jones and Jones in 1975. It is noteworthy for the particular focus on the aesthetic characteristics of the fixed, looped meander, braided and branched channels of the Susitna River. As such, it suggested a way of classifying the visual attributes of each river channel type as it exists in the planning unit.

2. Topographic Maps: The USGS maps provided specific locational information on the river channel types as well as the location and character of other surface water features.

Cultural Modification Information

1. CD11, World Aeronautical Chart - 1:1,000,000. The Department of Commerce aeronautical charts provided a primary base for locating airstrips and guiding the field overflights.

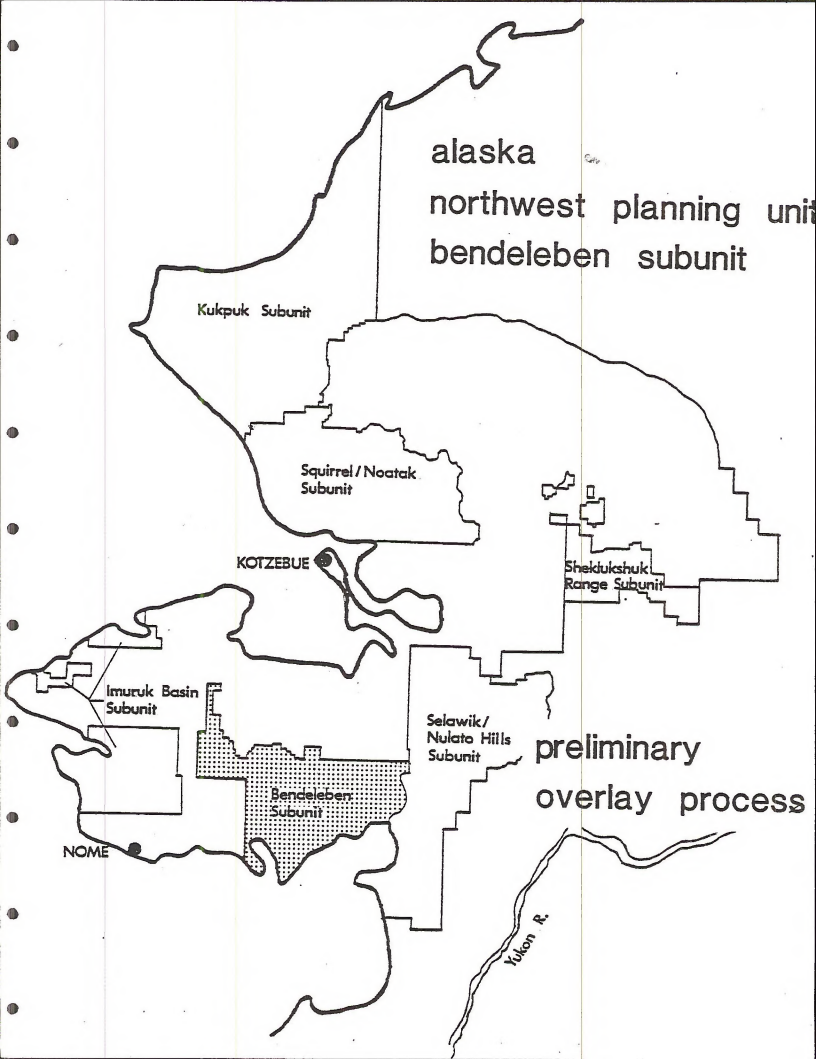
2. Topographic Maps: The USGS topographic maps once again played a key role in the location and extent of cultural modifications including roads, villages, mine sites, airstrips, etc.

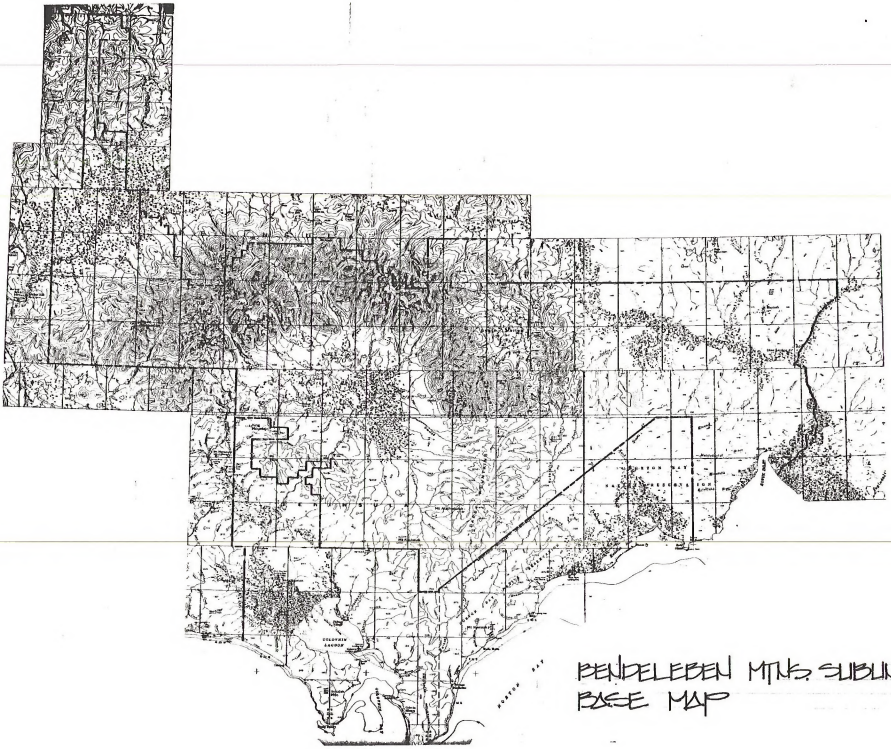
APPENDIX B

Format of commonly used maps. The purpose to which a map is applied controls the scale, level of detail appropriate, and size of the minimum map unit. Effective use of data presented in map format is dependent on understanding these relationships.

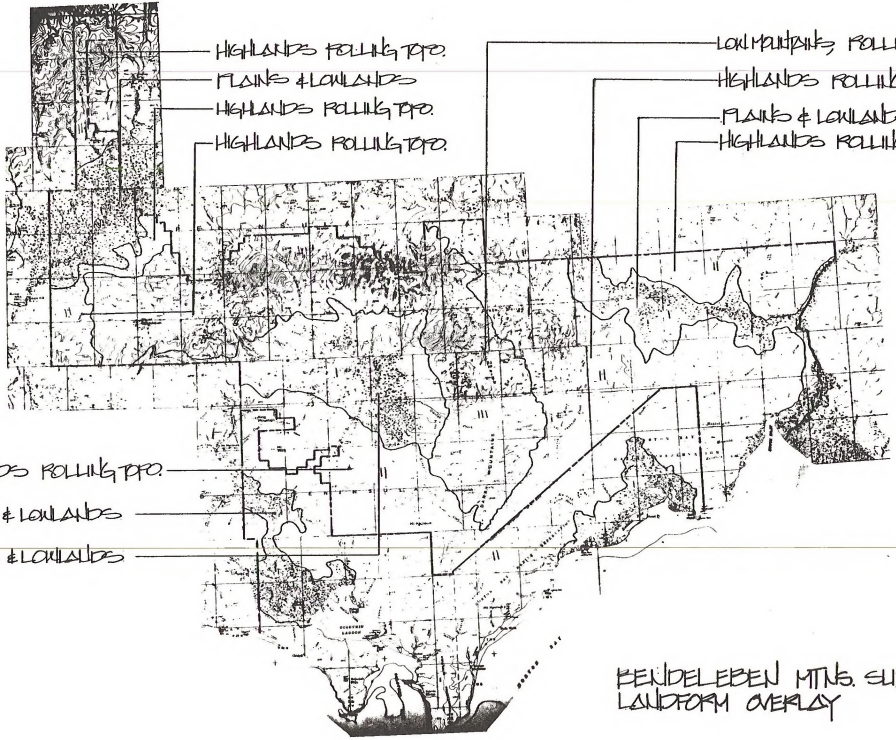
Scale	Level of Detail	Size of Minimum Map Unit	Use
1:1,000,000	Broad Level I*	5,000 acres	Regional planning Reports (data presentation)
1:250,000	Broad or generalized Level I, Level II*	320 acres	Regional planning
1:63,360	Moderate Level II, Level III,* (Level IV)	20 acres	Locational planning Resource inventories Resource Management
Larger scales	Specific Level IV, Level V*	5 acres or less	Site planning Site management Access Land conveyance Development Land status

* Provisional classification framework for Alaskan vegetation. (Viereck and Dyrness, 1980)

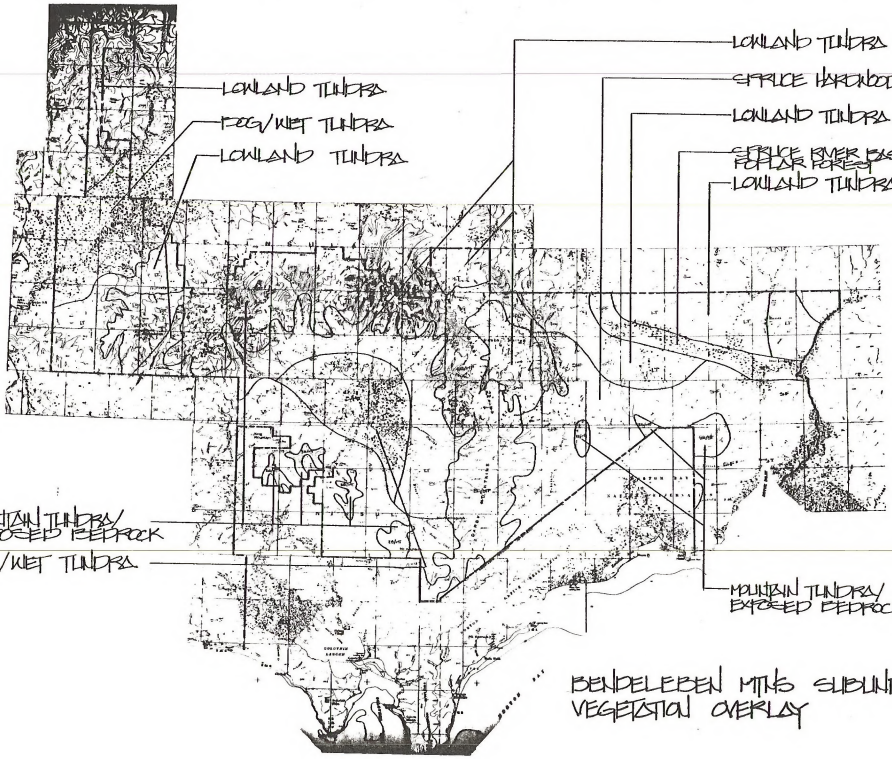

alaska
northwest planning unit
bendeleben subunit
Kukpuk Subunit
Squirrel / Noatak Subunit
KOTZEBUE
Shekdukshuk Range Subunit
Imuruk Basin Subunit
Selawik/ Nulato Hills Subunit
preliminary
overlay process
Bendeleben Subunit
NOME
Yukon R.



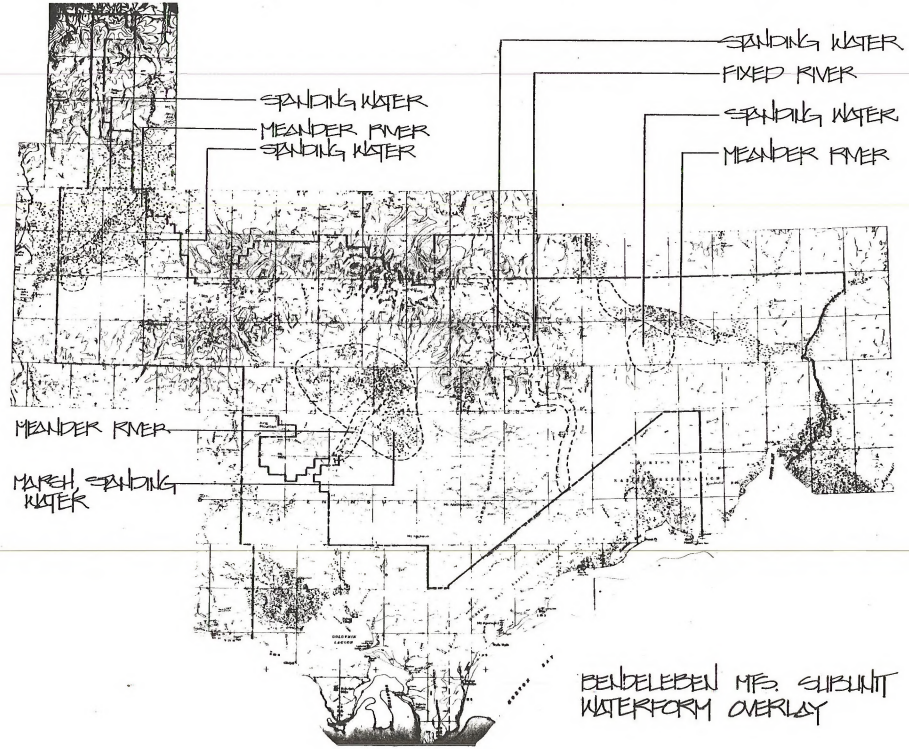
BENDELEBEN MTNS. SUBUNIT
BASE MAP



BENDELEBEN MTNS. SUBUNIT
LANDFORM OVERLAY



BENDELEBEN MTNS SUBUNIT VEGETATION OVERLAY



BENDELEBEN MFS. SUBUNIT
WATERFORM OVERLAY

Appendix C
Literature Cited

American Society of Photogrammetry. 1968. Manual of color aerial photography. 1st Edition. American Society of Photogrammetry, Falls Church, Va. 550p.

Fenneman, N.M. 1946. Physical divisions of the United States: United States Geological Survey, scale 1:7,000,000, reprinted 1949.

Gordon, Richard J. and Beryamin A. Shaue, 1978. Alaska natural landscapes. Federal-State Land Use Planning Commission for Alaska, Commission Study 33.

Joint Federal State Land Use Planning Commission for Alaska. 1973. Major Ecosystems of Alaska. Scale: 1"=40 miles.

Jones and Jones. 1975. Upper Susitna River Alaska: An inventory and evaluation of the environmental, aesthetic and recreational resources. A study done for the Alaska District, Corps of Engineers, Anchorage, Alaska.

Litton, R. B., Jr., 1968. Forest landscape description and inventories.... a basis for land planning and design. USDA for Ser. Res. Pap. PSW-49.

Litton, R. Burton, Jr. 1974. Visual vulnerability of forest landscapes. Journal of Forestry 72(7):392-97.

Litton, R. B., Jr. and R. J. Tetlow, 1978. A landscape inventory framework: scenic analysis of the Northern Great Plains. USDA for. Ser. Res. Pap. PSW-135.

Litton, R. Burton, Jr. 1979. Visual vulnerability of the landscape: some factors affecting control of visual landscape quality. Draft. Final report under cooperative agreement No. 21-371 between Department of Landscape Architecture, University of California Berkeley and Pacific Forest and Range Experiment Station, Berkeley, Ca. 36p.

Munsell, Albert Henry. 1972. Munsell color charts for plant tissues. 2nd Edition. Munsell Color Division, Baltimore, 20p.

Research Planning and Design Associates, 1970. North Atlantic regional water resources study: appendix N, visual and cultural environment. Prepared for the North Atlantic Regional Water Resource Study Coordinating Committee, Amherst, Mass. 281 p.

Scheele, Robert, 1980. Landscape Visual Resource Description. Unpublished report done for Yukon-Kuskokwim Planning Unit, McGrath Resource Area, Anchorage District, Alaska Office, Bureau of Land Management.

Selkregg, Lidia L. 1974. Alaska regional profiles, Volume V, Northwest Region. University of Alaska, Arctic Environmental Information and Data Center.

Spetzman, L. A., 1963. Terrain Study of Alaska, Part V: Vegetation. Military Geology Branch, U.S. Geological Survey. (Scale 1:2,500,000)

Steinitz, Carl, Paul Parker and Laurie Jordan. 1976. Handdrawn overlays: their history and prospective uses. Landscape Architecture September 1976:444-55.

Stone, Edward H, II. 1978. Visual resources management. Landscape Architecture Technical Information Series, Volume 1, No. 2. American Society of Landscape Architects, Washington, D.C.

U.S. Army Corps of Engineers, Alaska District. 1967. Harbors and rivers in Alaska, Interim report no. 6, Northwestern Alaska.

U.S.D.A. Soil Conservation Service. 1979. Exploratory soil survey of Alaska. National Cooperative Soil Survey. U. S. Government Printing Office: 1979-247-478/68. 213p.

Viereck, Leslie A. and C.T. Dyrness. 1980. A preliminary classification system for vegetation of Alaska. U.S.D.A. Forest Service General Technical Report PNW-106,38p.

Wahrhaftig, Clyde. 1965. Physiographic divisions of Alaska. United States Geological Survey Professional Paper 482, 52p.

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